
Personal Finance: Another Perspective

# Investing 4: Bond Basics

Updated 2020/02/21


# Objectives

- A. Understand benefits, risk, terminology and the major types of bonds
- B. Understand how bonds are valued and the costs of investing in bonds
- C. Understand plans and strategies for bonds


# A. Understand Benefits, Risk, Terminology and Types of Bonds

- Why Consider Bonds in your portfolio?
  - Bonds reduce risk through diversification.
  - Bonds produce steady current income.
  - Bonds can be a safe investment if held to maturity.
  - Bonds are less risky than stocks, although their returns are lower as well.
  - If interest rates drop, bond prices will rise.


# Risk and Return (continued)

- What are some risks of bonds?
  - Interest rate risk
    - Risk that a rise (fall) in interest rates will result in a decline (rise) in the bond's value
  - Inflation risk
    - Risk that a rise (decline) in inflation will result in a decrease (increase) in the bond's value
  - Business risk
    - Risk that the bond's value will decline due to problems with the company's business
  - Liquidity risk
    - Risk that investors will be unable to find a buyer or seller for a bond when they need to sell or buy


# Risk and Return (continued)

- Financial risk
  - How the firm raises money could affect the financial performance of the firm and the value of the bonds
- Political or regulatory risk
  - Unanticipated changes in the tax or legal environment will have an impact on a company's bonds
- Exchange rate risk
  - Risk that changes in exchange rates will impact profitability for firms working internationally

# Bond Terminology

- What terms should I should about bonds?
  - Par value
    - The face value or amount returned at maturity
  - Coupon interest rate (or interest rate)
    - The percentage of the par or face value paid annually to the holder in interest
  - Maturity date
    - The date when the loan must be paid back
  - Price
    - The price that the bond sells for


# Bond Terminology (continued)

- Call provision
  - Allows the issuer to repurchase the bonds before the maturity date at the issuers discretion
  - Deferred calls provide more protection.
- Sinking fund
  - Money set aside annually to pay bonds at maturity
- Yield
  - The annual interest on a bond divided by its price
- Issuer
  - The corporation or government agency that issues the bond


# Bond Terminology (continued)

- What is term or bond maturity?
  - Short-term
    - Bonds with maturity usually a year or less
  - Intermediate-term
    - Bonds with a maturity of 2 to 10 years
  - Long-term
    - Bonds with a maturity of greater than 10 years


# Bond Terminology (continued)

- How are bonds issued:
  - Book-entry bonds
    - Bonds which are registered and stored electronically, similar to stock purchases
  - Bearer bonds
    - Bonds with coupons attach that pay interest only to the bearer upon surrender of the coupons
  - Baby bonds
    - A bond with a par value of less than $1,000


# Bond Terminology (continued)

- Discount bonds
  - A bond that is sold at a discount to its par value. Generally, upon maturity the accrued interest and original investment add to the bond's par value
- Callable bonds
  - A bond that can be redeemed prior to its maturity date at the option of the issuer
- Redemption
  - The process of redeeming a callable bond before its maturity date


# Bond Terminology (continued)

- How are bonds backed?
  - Asset backed bonds
    - Bonds backed by specific holdings of the issuing company, such as equipment or real estate
  - Debentures
    - Bonds backed by the credit of issuing company
  - Mortgage-backed bonds
    - Bonds backed up by a pool of mortgages
  - Collateralized mortgage obligations (CMOS)
    - More complex and specialized versions of mortgage backed bonds


# Bond Terminology (continued)

- What conditions might bonds have?
  - Subordinated bond
    - Bond that will be paid after the other loan obligations of the issuer are paid
  - Floating rate bond
    - Bond whose interest payments fluctuate according to a specific benchmark interest rate
  - Convertible bond
    - Bond which gives the holder the right to convert the bond to company stock instead of getting the cash repayment


# Bond Terminology (continued)

- Callable bonds
  - Bonds which can be called, i.e. redeemed, before maturity at the option of the issuer.
- Zero-coupon bonds
  - A discount bond which pays no interest until maturity.
- Junk Bonds
  - Bonds with very low bond ratings, a higher interest rate and default rate, and are almost always callable


# Bond Terminology (continued)

- What are bond ratings?
  - Bond ratings are measures of the riskiness of a company. Ratings run from "AAA" (Standard & Poor's) or "aaa" (Moody's) for the safest to "D" for the extremely risky
  - Ratings categorize bonds by default risk, the risk of the company being unable to repay the bond
- The major rating companies are:
  - Standard & Poor's
  - Moody's
  - Fitch's

# Bond Terminology (continued)

- What is a bond rating company?
  - A private sector company that evaluates the financial condition of the bond issuing company, its revenues, profits, debt, and other critical areas, and gives the company a rating which indicates the relative safety of the bond
    - Generally, the better the bond rating, the lower the interest rate the company will have to pay to sell its bonds
  - Only rate corporate and municipal bonds


# Major Bond Types

While there are many different types of bonds, they fall under a few major headings:

- Corporate
- Treasury Debt Securities
- Municipal
- Agency
- International
- Treasury Savings Securities


# Major Bond Types (continued)

- Corporate Bonds
  - Types:
    - Bonds secured corporate debts by collateral or real property liens
      - Secured bond, Mortgage bond
    - Unsecured corporate debts
      - Bonds not secured by collateral, and pay a higher return
    - Debenture
      - Long-term unsecured bond
      - Can have a hierarchy of payment, with unsubordinated and subordinated debentures


# Major Bond Types (continued)

- Issuer: issued by U.S. corporations
- Maturities: Can have many different maturities
  - Short-term: 1 to 5 years
  - Intermediate term: 6 to 10 years
  - Long-term: 11 to 30+ years
- Par value: $1,000 and up
- Taxes: Subject to federal, state and local taxes
- Risk and Return: More risky than government bonds, but higher returns. Very little risk with highest rated bonds
- Rated: Yes
- Trading: By brokers, either OTC or on an exchange
- Callable: Yes

# Major Bond Types (continued)

- U.S. Treasury Debt Securities
  - Types:
    - Treasury Bills
      - A short-term debt obligation issued at a discount and redeemed at face value upon maturity in 3, 6, or 12 months
    - Treasury Notes
      - An intermediate-term debt obligation issued at or near par and interest paid semiannually.
    - Treasury Bonds
      - A long-term debt obligation issued at or near par and interest is paid semiannually.
  - Issuer: U.S. government


# Major Bond Types (continued)

- Maturities: 3 months to 30 years
- Par Value: (T-bonds/notes) $1,000, $5,000 (all) $10,000 to $1 million
- Taxes: Exempt from state and local taxes, but not federal taxes
- Risk and Return: Government securities, so considered risk free.
  - However, with lower risk, returns are lower as well
- Rated: No
- Trading: Auction, at the Federal Reserve. Outstanding issues by brokers, OTC
- Callable: Usually not


# Major Bond Types (continued)

- Municipal bonds
  - Types:
    - Revenue bonds: Bonds backed by the revenues of a specific project
    - General Obligation bonds: Bonds backed by the taxing power of the issuer
  - Issuer: Issued by state and local governments
  - Maturities: Can have many different maturities
    - Short-term: 1 to 5 years
    - Intermediate term: 6 to 10 years
    - Long-term: 11 to 30+ years
  - Par Value: $5,000 and up


# Major Bond Types (continued)

- Taxes: Exempt from federal tax on interest
  - May also be exempt from state and local tax on interest if the investor lives in the state from which the bond was issued
- Risk and Return: Risk is higher than government bonds, while returns may be lower, due to federal tax exemption.
- Rated: Yes
- Trading: Brokers, OTC
- Callable: Sometimes

# Major Bond Types (continued)

- Agency bonds
  - Types:
    - Issued by government agencies which were authorized by Congress
      - Federal National Mortgage Association (FNMA)
      - Federal Home Loan Banks (FHLB)
      - Government National Mortgage Association (GNMA)
    - Issues by state and local agencies
  - Issuer: Bonds issued by various federal, state, or local agencies or institutions


# Major Bond Types (continued)

- Maturities: Can have many different maturities
  - Short-term: 1 to 5 years
  - Intermediate term: 6 to 10 years
  - Long-term: 11 to 30+ years
- Par Value: $25,000 and up. Generally higher minimum investment required.
- Taxes: Ginnie Mae, Fannie Mae, and Freddie Mac are taxable. Other federal agencies are state and local tax exempt.
- Risk and return: Somewhat higher risk and return than Treasury bonds
- Rated: Some issues are rated
- Trading: Brokers, OTC, directly through banks
- Call Provisions: Not callable


# Major Bond Types (continued)

- International Bonds
  - Types:
    - International Bonds
      - Bonds issued by international companies and sold internationally in various currencies
    - Yankee Bonds
      - Bonds issued by international companies and sold in the U.S. in U.S. dollars
    - Euro Bonds
      - Bonds issued by U.S. companies and sold outside of the U.S. in U.S. dollars
  - Issuer: Issued by U.S. or international corporations


# Major Bond Types (continued)

- Par value: $1,000 and up, may be in different currencies
- Taxes: Subject to US federal, state and local taxes. May also be subject to foreign taxes
- Risk and Return: Varies. More risky than government and corporate bonds, but higher returns. May also have currency risk as well.
- Rated: Generally yes for US and larger intl. firms
- Trading: By brokers, either OTC or on an exchange
- Callable: Generally yes

# Major Bond Types (continued)

- US Treasury Savings Securities
  - Types:
    - US Savings EE Bonds
    - US Savings I (inflation linked )bonds
  - Issuer: Bonds issued by the U.S. government, and tax deferred until maturity
    - Are not marketable, but redeemed from local banks
    - I and EE bonds sold at face value, with interest paid at maturity
  - Maturities: Can be held to different maturities, but interest stops after 30 years
  - Maturity: Generally cannot be redeemed before 5 years without penalty. Can hold for up to 30 years.


# Major Bond Types (continued)

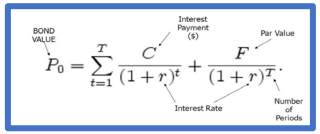
- Par Value/Denomination: $25, $50, $100, $1,000 and $10,000
- Maximum purchase of $10,000 per year electronic form and $5,000 per year in from your federal tax refund
- Taxes: Registered bearer bonds exempt from state and local taxes on interest. Interest is Federal tax-free if used for qualified educational expenses (EE and I bonds)
- Risk and Return: Government backed so little risk.
  - EE and I bond returns are variable, changes every 6 months.
- Rated: No, as these are government securities
- Trading: Not traded. Can be purchased over the internet at Treasurydirect.gov and cashed at federal banks
- Callable: no


# B. Understand How Bonds are Valued

- How are bonds valued?
  - Bonds are valued in many ways. Generally, the value of a bond is determined by the price paid for the bond, and the discounted value of all of its interest payments and the repayment of its par value
    - The three key inputs are:
      - The price and the par value of the bond
      - The maturity and coupon interest payments
      - The discount rate of the investor
  - The price of the bond is the present value of the price, interest payments, and future par value all discounted at the investors discount rate

# Valuation Principles (continued)

- What is the relationship between key inputs?
  - Price and Par Value
    - A bond whose price is less (more) than its par value is trading at a discount (premium) to par
      - Bonds trade at below (above) par when the interest rate of the bond is lower (higher) than prevailing market interest rates
    - Suppose you own a 5 year bond with a 6% coupon rate. If market interest rates were 4% now, because your bond has a higher than 4% rate, investors would have to pay you more for that bond, i.e. $108.90.

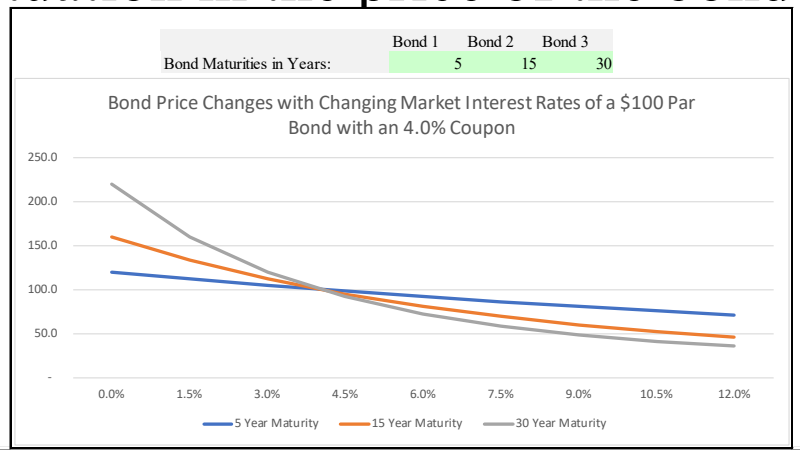



$$P_0 = \sum_{t=1}^{T} \frac{C}{(1+r)^t} + \frac{F}{(1+r)^T}$$

| | |
|---|---|
| Bond Par: | 100 |
| Coupon: | 6.0% |
| Payments a year: | 1 |
| Current Rates: | 4.0% |
| Maturity (years): | 5 |
| Coupon Payment: | $ 6.00 |
| Gain (Loss): | 8.9% |
| Bond Price: | $108.90 |

# Valuation Principles (continued)

- Maturity and Price
  - The longer (shorter) the time to maturity the greater (smaller) the fluctuation (see Investment Expenses LT43, Bond Prices Tab)
    - Since bonds take into account current changes in interest rates, if those rates increase, the longer (shorter) the maturity the greater (smaller) the fluctuation in the price of the bond



# Valuation Principles (continued)

- Investor's discount rate and price
  - The value of a bond is related to the investor's discount rate
    - Bonds are valued at the discount rate required by the investor.
      - If the discount rate increases (decreases), the investor will require a higher (lower) return on all cash flows, and hence a lower (higher) price
    - Since coupon payments are fixed (generally) for the life of the bond, the only input that can change to adjust for changes in the investor's discount rate is the bond price


# Valuation Principles (continued)

- Why would an investors' discount rate change?
  - The investor perceives a change in the risk associated with the firm issuing the bond
    - As perceived risk increases, the investor's discount rate increases
  - The investor perceives a change in general market interest rates
    - As general interest rates in the market increase, investors require a higher discount rate to invest
  - The investor perceives a change in the general risk in the market (the market risk premium)
    - As the riskiness of the market increases, investors require a higher rate to invest

# Valuation Principles (continued)

- What is the bond yield?
  - Is the total return on a bond investment
  - Is not the same as the interest rate
  - Is affected by the bond price which may be more (a premium to) or less than (a discount to) face value
- How you do measure bond yield?
  - Current yield
  - Yield to maturity
  - Equivalent taxable yield on muni's

# Valuation Principles (continued)

- Current Yield
  - Ratio of annual interest payments to the bond's market price
  - It is calculated as:
    - Annual interest payments / Market price of the bond
    - Since the interest payments are fixed, the only variable that can change is the price of the bond.


# Valuation Principles (continued)

- Yield to Maturity
  - This is the true yield received if the bond is held to maturity, which assumes that all interest payments can be reinvested at the same rate.
    - It is a cash flow problem, that is best solved by use of a calculator. The approximate yield to maturity is:

$$(AIP + (PV - CP)/YM) / ((PV-CP)/2)$$

AIP = annual interest payments

PV = Par value

CP = Current market price

YM = Years to maturity


# Valuation Principles (continued)

- Equivalent taxable yield (ETY) (see LT26 – Teaching tab for an numeric explanation)
  - The yield that must be offered on a taxable bond to give the same after-tax yield on a tax-exempt bond
    - Equivalent Taxable Yield Equation is:
      - ETY = Tax-free yield / (1 – marginal tax rate)
        - MTR = federal, state, and local taxes
  - Note:
    - It is critical that you understand the tax implications of each type of bond to calculate after-tax return, i.e. muni bond interest is free from federal tax, treasury debt securities are free from state and local taxes, etc.


# Valuation Principles (continued)

- Remember the principles of investing when investing in bonds:
  - Invest tax-efficiently
    - It's not what you make, but what you keep after taxes. Take into account the tax implications of bonds
  - Invest low-cost
    - Buy a bond when it is first issued, rather than in the secondary market
  - Stay diversified
    - Consider investing in a portfolio of bonds. If buying single bonds, consider only high quality bonds

# Valuation Principles (continued)

- Watch market interest rates
  - Keep the inverse relationship between interest rates and bond price in mind
    - If interest rates are likely to rise (fall), invest in short-term (long-term) bonds
- Know what you are investing in
  - Avoid bonds that might get called.
  - Stick to large issues which are more liquid
- Know yourself and your goals
  - Match your bond's maturity to your investment time horizon.


# Costs of Investing in Bonds

- What are the costs of investing in bonds?
  - Explicit Costs
    - Commission costs
      - All bond trades incur commission costs
        - Some newly issued bonds are sold without commission cost as the issuer absorbs the costs
        - Most trades however, incur commission costs, which are paid to the broker who arranged the trade
    - Markup
      - This is the difference between the buying price and the calculated selling price


# Costs of Investing in Bonds (continued)

- Explicit costs (continued)
  - Custody (or annual) fees
    - These are fees the brokerage house charges to hold the bonds in your account.
      - May be a minimum amount for small accounts ($15 per year), a specific charge per holding (8 basis points per security), or a percentage of assets for large accounts (25 basis points on assets under management)


# Costs of Investing in Bonds (continued)

- Implicit costs
  - Taxes:
    - Taxes must be taken into account to get the true return of your portfolio but which are not noted on your monthly reports
  - Interest
    - Interest is the coupon payment received each period. These are taxed at your marginal tax (MTR).
      - This is an expensive type of income

# Costs of Investing in Bonds (continued)

- Implicit costs (continued)
  - Capital Gains
    - This is the difference between what you paid for the bond and what you sold it for, or the par value if you held the bond to maturity
    - Short-term:
      - Gains made in selling bonds owned less than 1 year. They are taxed at your MTR
    - Long-term Capital Gains:
      - Gains made in selling bonds held for more than 1 year. These are taxed at 5-15% depending on how long you have held the assets


# Costs of Investing in Bonds (continued)

- Hidden Costs (at the account level)
  - Beyond the explicit and implicit costs, look for the following hidden costs:
    - Account Transfer Fees
      - Charges for moving assets either into our out of an existing account
    - Account maintenance fees
      - Fees for maintaining your account
    - Inactivity/Minimum balance fees
      - Fees because you did not trade or have account activity during the period or because you failed to keep a minimum balance in your account

# Bond Prices and Interest Rates (LT43b)

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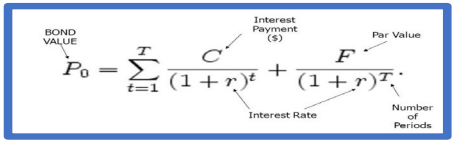



$$P_0 = \sum_{t=1}^{T} \frac{C}{(1+r)^t} + \frac{F}{(1+r)^T}$$

| | |
|---|---|
| Bond Par: | 100 |
| Coupon: | 4.0% |
| Payments a year: | 1 |
| Current Rates: | 8.0% |
| Maturity (years): | 5 |
| Coupon Payment: | $ 4.00 |
| Gain (Loss): | -16.0% |

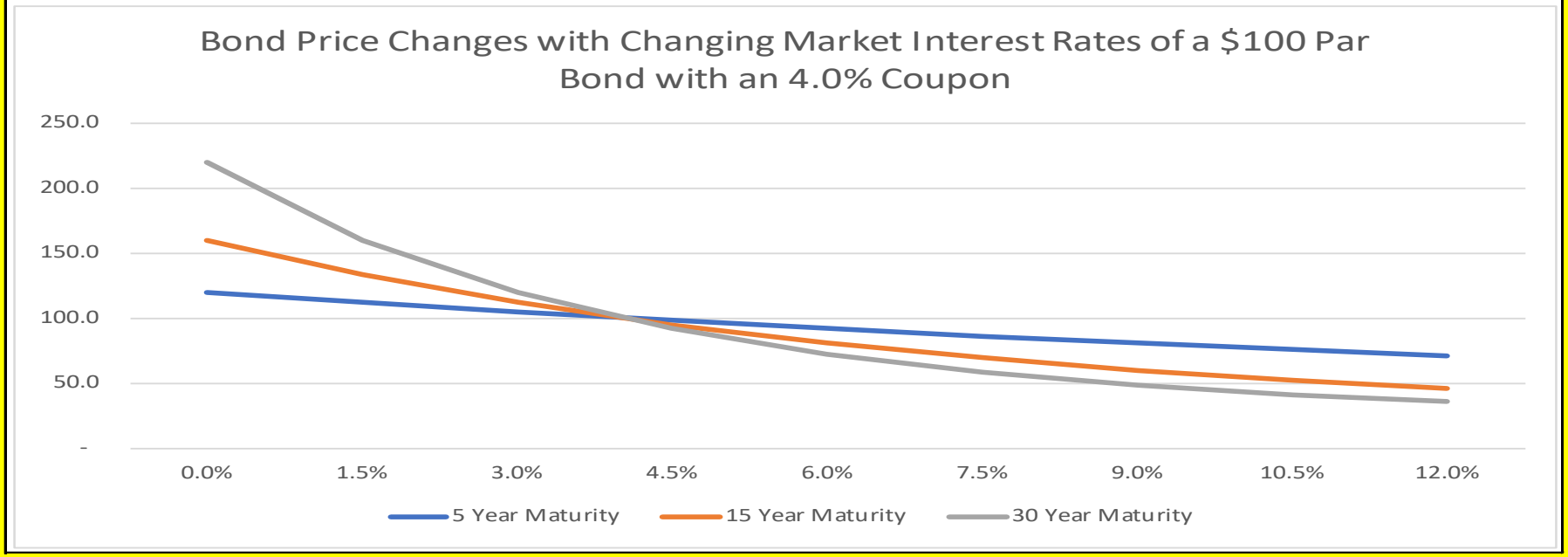
4.0% Bond Price @ 8.0% Rates: **$84.03**

| | Years | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Coupon/Principal: | 4 | 4 | 4 | 4 | 104 |
| Discount Factor: | 1.08 | 1.17 | 1.26 | 1.36 | 1.47 |
| Present Value: | 3.70 | 3.43 | 3.18 | 2.94 | 70.78 |

*Bonds Lesson 1:* ***As market rates rise/(fall), the price of the bond falls (rises) Bond prices and interest rates move in opposite directions***

*Bonds Lesson 2:* ***The longer the maturity, the larger the effect of the rate change. The % gain(loss) from rates changing from 4.0% to 8.0% is -16.0%, the difference between $100.00 and $84.03.***

| | Bond 1 | Bond 2 | Bond 3 |
|---|---|---|---|
| Bond Maturities in Years: | 5 | 15 | 30 |




# C. Understanding Plans and Strategies for Investing in Bonds

- Following are a few ideas for your plans and strategies for bonds/bond mutual funds

# Plans and Strategies for Bonds (continued)

- Plans and Strategies

  *General Investing*

  - Individual bond risk is high, so bond index/ETF/funds can reduce risk considerably
  - Use bonds wisely to mitigate the risk of the portfolio
  - Using many different types of bonds/bond funds, I can invest at differing risk levels within this asset class (short-, intermediate-, or long-term corporate bonds, treasury securities, muni bonds, etc.)
  - Individual tax rates can have a significant impact on your choice of bonds/bond funds so invest wisely


# Plans and Strategies for Bonds (continued)

*General Investing (continued)*

- Bonds/bond funds generally will not give returns needed to grow your portfolio much above inflation, so consider them as part of your diversified portfolio
- As you age and get closer to retirement, bonds are a generally a good compliment as they offer more stability of principle and income, and are generally less volatile than equities
- As you review bonds for your portfolio, make sure you follow the principles of successful investing


# Review of Objectives

A. Do you understand risk, return, terminology and types of bonds?

B. Do you understand how bonds are valued and the costs of investing in bonds?

C. Do you understand some plans and strategies for bonds?


# Case Study #1

Data

- You are considering purchasing a bond with a 5.00% coupon interest rate, a par value of $1,000, and a market price of $990. The bond will mature in 9 years.

Calculations

a. What is the bond's current yield?

b. Calculate the bond's yield to maturity using your financial calculator.

# Case Study #1 Answer

- The bond's current yield is the annual interest payments divided by the price. Interest payments are coupon times the par value or 5% * 1,000 or $50. The price of the bond is $990, so the yield is:
  - $50/$990 or 5.05%.
- To calculate the YTM, set PV = -990, PMT = 50, FV = 1,000, N=9, P/Yr = 1 and solve for your interest rate?
  - I = 5.14%
- Note: Since you paid less for the bond than par, and your coupon interest rate was 5%, that would increase your YTM.

| Excel Financial Calculator (LT12) | | |
|---|---|---|
| The Interest Rate is 5.14% | | |
| Present Value = | PV | ($990) |
| Years/Periods* = | N | 9.00 |
| Payments/Year = | P/Yr | 1 |
| (Compounding: Ann. = 1, Mon. = 12, Qrtly. = 4) | | |
| Annual Interest = | $I_{real}$ | 5.14% |
| Ann. Nom. Rate = | $I_{nom}$ | 5.14% |
| Ann. Inflation = | $I_{infl}$ | |
| 1 Period Rate = | | 5.14% |
| Future Value = | FV | $1,000 |
| Payments = | PMT | $50.00 |

# Case Study #2

Data

- Three friends, Kimberly, Natalie, and Clinton are from Nevada where there is no state income tax. They have asked you to determine the equivalent taxable yield on a municipal bond. This municipal bond is from the same state as your friends, and is exempt from state and local taxes in addition to federal taxes. The bond's current yield is 3.75% with 5 years left until maturity. Kim is in the 15% tax bracket, Natalie is in the 28% tax bracket, and Clinton is in the 35% tax bracket. Calculate the ETY for your three friends.

Calculations

- Assuming a taxable bond yields 5.0%, which of your friends should purchase the municipal bond?

# Case Study #2 Answer

- Kimberly is in the 15% federal marginal tax bracket, so the equivalent taxable yield is:
  - 4.41% or 3.75% / (1-.15)
- Natalie is in the 28% federal marginal tax bracket, so the equivalent taxable yield is:
  - 5.21% or 3.75% / (1 -.28)
- Clinton is in the 35% federal marginal tax bracket, so the equivalent taxable yield is:
  - 5.77% or 3.75% / (1-.35)
- Assuming a corporate bond yields 5.0%, only Kimberly would purchase the corporate bond.

# Case Study #3

- Data
  - You paid $1,000 for a Boston Scientific bond at the end of the previous year. At the end of last year, the bond was worth $1,050. You are in the 25% federal marginal tax rate, and you live in a state that has no state income tax. Over the course of last year, you received $40 in coupon interest payments.
- Calculations
  - a. What was your before-tax return for the bond?
  - b. What is your after-tax return assuming you did not sell the bond?


# Case Study #3 Answer

- Calculations
  - a. You only pay taxes on realized income, not unrealized income. Your before tax return is:
    - ($1,050 – 1,000 + 40) /1,000 or
    - 9.0%
  - b. Your after-tax return would include the unrealized capital gains and the interest after you paid taxes. This interest it is taxed at your marginal tax rate of 25%. The after-tax return is:
    - (1,050 – 1,000 + [40 * (1 - .25)])/1,000 =
    - 8.0%
    - Of the $40 coupon, you pay $10 in taxes and keep the remaining amount.